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Public Health Reports

Treasury Department, United States Marine-Hospital Service. Published in accordance with act of Congress approved February 15, 1893.

VOL. XV. WASHINGTON, D. C., MAY 25, 1900. No. 21.

NOTICE.

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UNITED STATES.

PRELIMINARY NOTE ON THE VIABILITY OF THE BACILLUS PESTIS.

M. J. Rosenau, Passed Assistant Surgeon, and Director of the Hygienic Laboratory, United States Marine-Hospital Service.

There seem to be three factors that influence the life of the bacillus pestis in the outer world, viz, light, moisture, and temperature. The bacillus withstands quick drying very badly, as all the experiments in this direction indicate. It can not live long in the sunshine. High temperatures are invariably fatal.

That it always and under all circumstances dies in so short a time as five days, as the work of Kitasato and Wilm first indicated, must now be doubted in view of the experience of Abel, Ficker, Batzaroff, Hankin, The German Plague Commission, Germano, Giaxa, and myself.

The bacillus of plague does not exist in nature on glass cover slips, nor yet in the desiccator over concentrated sulphuric acid. With us it certainly would not be exposed to drying in our houses, and on fabrics at temperatures of 30° and 37° C., conditions under which many of the tests to determine the viability of the organism were made.

We ought, therefore, not to apply the experience of the laboratory too literally to the life history of the plague bacillus in nature, for we can not imitate all the conditions under which the organism may exist. We may determine with fair certainty the length of time the plague bacillus may live under given conditions; and in general terms we can state whether it is a hardy organism, resistant to influences usually detrimental to bacterial life, or one that loses its virulence and dies quickly when removed from its natural habitat.

In this laboratory we have worked with the organism from 5 sources, 1 from Djiddah, 1 from Oporto, 1 from Rio de Janeiro, 1 from Bombay, and 1 from the New York quarantine case. We find that all these 5 races thrive well under the usual laboratory conditions, on the ordinary media.

They can in no sense be considered tender organisms as was at first supposed. They are much easier to cultivate than the lanceolate coccus of pneumonia or the streptococci. In fact they resemble more closely the hardier of the hemorrhagic septicæmic group.

In this connection, Batzaroff(*a*) states: "It may be said that it is a mistake to consider the microbe of human pest to be very frail. There undoubtedly exist varieties that attenuate very quickly, and die outside the living body in a relatively short time. There are other varieties that retain their viability under similar conditions a long time, and continue to live in artificial media for months and even years without notably losing virulence. We have seen that certain of our cultures which have been kept in the laboratory without any precautions and exposed to the light for three and one-half months, still kill animals when injected hypodermatically with but slight retardation; and that regenerated 2 or 3 times they almost regain the virulence they first possessed. It is not always easy to obtain an attenuated culture of pest. It requires much time and a combination of various artifices."

On first glance over the literature on the viability of the organism there appears to be an irreconcilable difference between the various observers as to the length of time the organism will live and maintain its virulence outside the body, but on closer study it becomes apparent that these differences are due to different conditions under which the experiments were carried out, especially differences in temperature. We must not lose sight of the fact that some races of the organism are more hardy than others.

It is the experience of all observers that the bacillus can not live long outside the body when dried at a temperature of 30° C. or over, but at a temperature lower than this and under 20° C., it has been kept alive sixty and seventy-five days.

The German Plague Commission (*b*) found that the organism always lost its power of infection when dried, within eight days, in India, but after returning to Germany could be kept alive after drying twenty-eight days, at 15° to 18° C.

My own experience indicates that the organisms, when dried, will

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a Batzaroff. La Pneumonie pesteuse Experimentale. Annales de l'Institut Pasteur, May, 1899, page 391.

b Kaiserliche Gesundheitsamte, Bd. 16, Berlin 1899, page 274, *et seq.*

die quickly if the temperature reaches 27° C. but that at 23° C. and under it may live a long time.

A series of experiments has been undertaken in this laboratory and a few of the results are given in advance showing how long the organism may live and retain its virulence when dried under various conditions.

ALBUMIN-GELATIN BALLS INFECTED WITH PLAGUE CULTURE.

A little ball of sterile absorbent cotton about the size of a pea is soaked with a few drops of a gelatin culture of plague (Djiddah) mixed with egg albumin, and exposed in a Petri dish in the photographic dark room (20° to 23° C.) and the cool chamber (17° to 19° C.).

The little balls soon dry and the gelatin-albumin shrinks to a flaky, dry, hard mass.

From time to time one of the dried balls is taken out, planted in bouillon, and incubated. In case a growth appears the organism is tested on all the media, and on mice.

It was found that the organism lived and remained virulent for mice under these conditions for seventy-five days in the dark room at about 20° to 23° C. and for seventy-five days in the cool chamber at 17° to 19° C. Whether it may live longer will be determined from time to time and reported later on.

CRASH INFECTED WITH PLAGUE CULTURE.

In another series of experiments little squares of fabric (crash) were sterilized and inoculated with a three-day-old bouillon culture of the bacillus pestis. One set of these was allowed to dry out in Petri dishes in a dark corner of the laboratory where the temperature ranges from about 20° to 27° C., another set in the cool chamber (17° to 19° C.), and another set in the photographic dark room (20° to 23° C.). The squares were removed at intervals and planted in bouillon and in case a growth appeared it was studied for purity and pathogenicity in media and mice.

The following are some of the results:

Bouillon culture on crash.

Time.	Laboratory 20° to 27° C.,	Cool chamber, 17° to 19° C.	Dark room, 20° to 23° C.
4 days	x	x	x
8 days	—	x	x
11 days	x	—	—
13 days	x	x	x
15 days	—	—	x
21 days	—	x Killed mouse in two days.	x Killed mouse in two days.
26 days	—	—	x Killed mouse in three days.
35 days	—	x	x
48 days	—	x Killed mouse in three days.	x Killed mouse in two days.

NOTE.—x indicates growth. — indicates no growth.

From this table it appears that the organism died after thirteen days when kept at a temperature which occasionally rose to 27° C.